Statistics in focus

ENVIRONMENT AND ENERGY

THEME 8 – 8/1999

ENVIRONMENT

Contents

Manuscript completed on: 31 May 1999
ISSN 1562-3106
Catalogue number: CA-NQ-99-008-EN-I

Sustainability indicators for transport

A reporting mechanism on transport and environment for the EU

It has been recognised for many years that transport is one of the main causes of impacts on the environment. Since the early 1990s, Eurostat and international organisations such as OECD have regularly published indicators which link trends in transport to environmental pressures, as well as measuring policy responses to these pressures. Such indicators are essential to support the EU's policy of integrating environmental concerns into other policy areas, as described in the Fifth Environmental Action Programme (1992).

Following the Treaty of Amsterdam, "integration" has been given a higher political priority. The Council gave a fresh mandate to the Commission in June 1998 to develop a comprehensive set of indicators of the sustainability of transport. This set of indicators will form the basis for a Transport and Environment Reporting Mechanism (TERM), which will be used to measure progress in the integration of environmental concerns in national and EU transport policies. The Council requested that the Commission should work on TERM in conjunction with the European Environment Agency (EEA) and that this work should take account of previous work in international organisations and in Member States, some of which already have well-developed systems of transport–environment indicators.

The Commission and the EEA have been working closely together to prepare the groundwork for establishing such an indicator-based transport and environment reporting mechanism for the EU. An annual transport and environment indicator report will be produced by EEA, and will be supported by a statistical compendium produced by Eurostat. A "zero version" of the indicator report will be published in autumn 1999, and serve as an input to the Helsinki Summit. The indicator report will be complemented with a series of focus reports on specific topics that require a more detailed approach and analysis. As an interim step, the EEA have compiled a two-volume report on the background to TERM, which is being published under the title:

Towards a transport and environment reporting mechanism (TERM) for the EU

Eurostat has contributed a number of indicators to this publication, primarily at EU level. Four examples of indicators used in TERM are presented here:

- Final energy consumption of transport
- Uptake of cleaner fuels
- Passenger transport
- Freight transport

Final energy consumption of transport

This indicator describes the evolution of the energy consumption of transport and compares it to that of the economy as a whole. In the EU the energy consumption of transport has in general grown faster than the energy consumption of any other sector over recent years. The indicator helps to describe this development.

The use of energy leads to a wide range of environmental impacts. In the case of transport, which is highly dependent on fossil fuels, this consumption mainly generates air emissions (greenhouse gases, particulates and acid compounds).

The indicator originally proposed was 'Transport share of final energy consumption and of total primary energy consumption', which would have provided a better basis for comparing the various modes. To date, however, it has not been possible to allocate energy consumption used in primary production (extraction) and transformation (refineries, power generation, etc.) specifically to transport so that for the time being the indicator is limited to final consumption.

Over the period 1985 to 1996 the energy consumption of transport (including road transport, railways, air transport, inland navigation[1] but also pipelines and marine bunkers[2]) has risen 28% (3.1% per year) in the EU (see Figure 1). Over the same period, the total final energy consumption of all economic sectors has risen only 13% (1.3% per year).

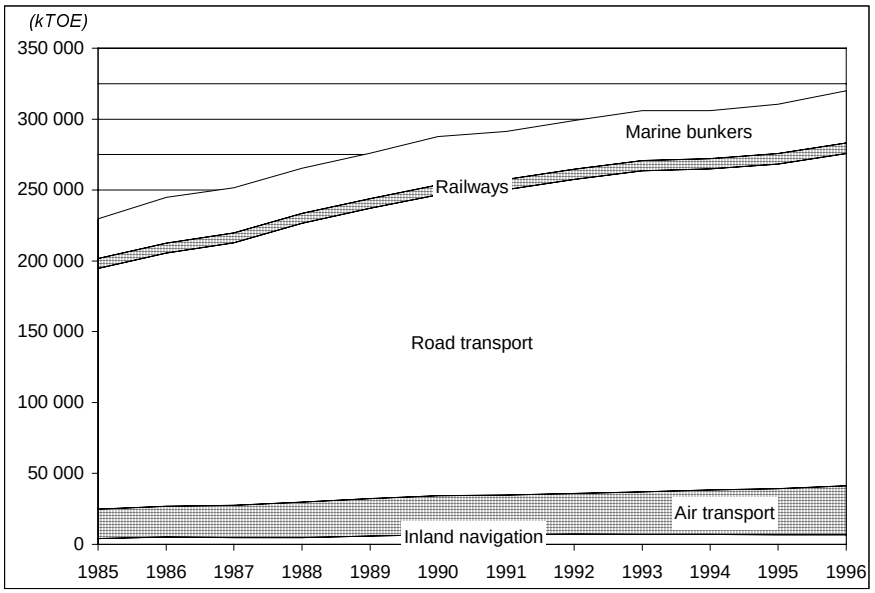

Figure 1: Final energy consumption of transport (EU-15)

NB: The two figures shown here are stacked graphs, in which each transport mode is added to the previous one and the top line represents their total. Care is therefore needed in interpreting the trends for each mode.

The transport share of total final energy consumption was 32.7% in 1996, as opposed to 27% in 1985, although it has fallen from a height of 33.5% in 1994 (see Figure 2).

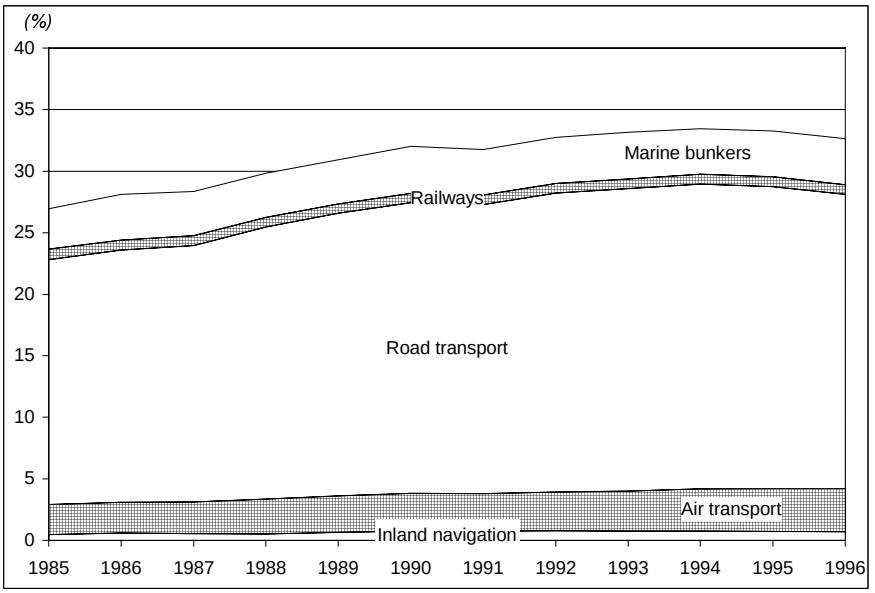

Figure 2: Transport share of total final energy consumption (EU-15)

[1] The exact definition of "inland navigation" is not clear, and may include coastal shipping. An attempt is being made to clarify this.

[2] Pipelines and marine bunkers are included in this indicator although they are not normally considered under "final energy consumption". The energy consumption of pipelines appears in the energy balance under "consumption of the energy branch". In the case of marine bunkers, although the fuel is consumed by maritime transport, it only loosely reflects the marine activity of the country and is therefore normally considered as an export of energy. To a lesser extent this is also true for aviation.

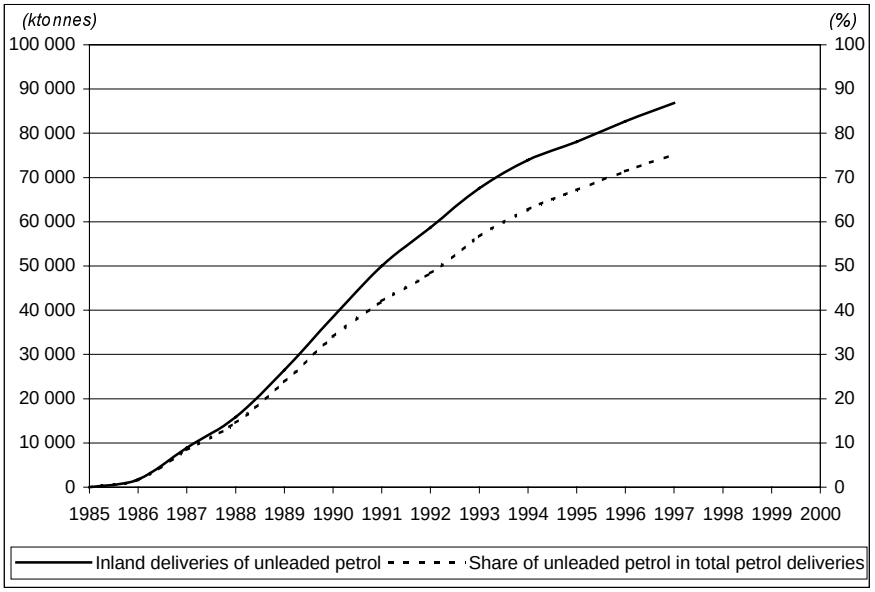

Figure 3: Inland deliveries of unleaded petrol (EU-15)

The purpose of this indicator is to show to what extent unleaded petrol is already in use, and how far conventional fuels have been replaced with "alternative transport fuels"[3] such as LPG (liquefied petroleum gas) and natural gas.

In 1997 the share of unleaded petrol in total inland deliveries of petrol stood at 75% for the EU as a whole, as opposed to 0% in 1985 (see Figure 3). Leaded petrol has been eliminated in Denmark, Germany, the Netherlands, Austria, Finland and Sweden. Directive 98/70/EC prohibits the marketing of leaded petrol within the territory of the EU by 1 January 2000.

Figure 4 shows the evolution in the consumption of LPG and natural gas.

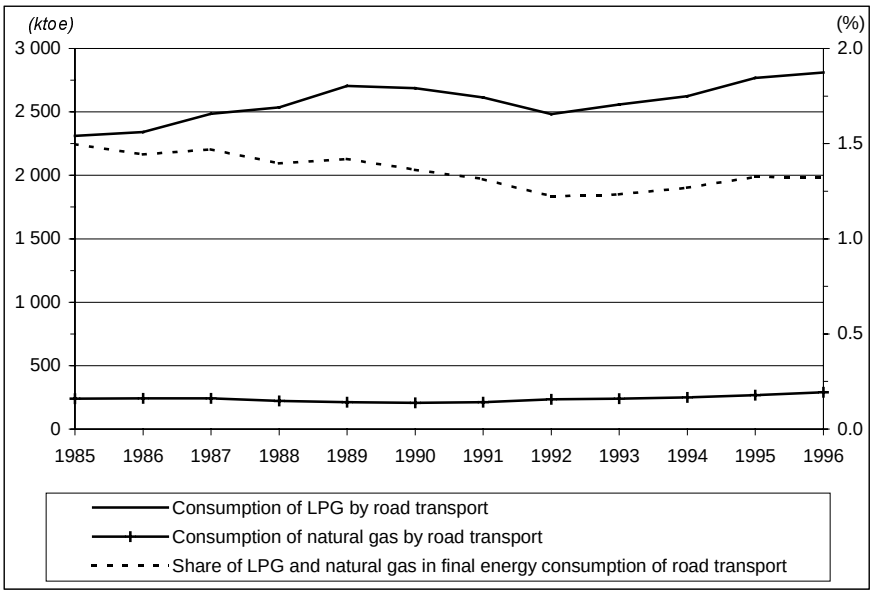

Figure 4: Consumption of alternative transport fuels (EU-15)

Between 1985 and 1996 consumption of LPG was far higher for Italy and the Netherlands than for the other countries. However, if Italy shows a growing trend, the Netherlands presents a decreasing one. Consumption in Germany shows some growth from 1995.

Data on natural gas are only reported by France, Italy and Austria, the only significant consumption being in Italy.

In conclusion, consumption of alternative transport fuels has been growing rather slowly (at about 1.8% per year). However, the share of alternative fuels in the total fuel consumption of road transport has diminished slightly, from 1.5% in 1985 to 1.3% in 1996.

New registrations of alternative-fuel vehicles (AFVs) have also been slowly increasing. Nevertheless they still represent only a very small proportion of the total vehicle stock.

Some Member States have introduced specific measures favouring the introduction of AFVs. For example, during 1998 France introduced a law obliging public bodies with a fleet of more than 20 vehicles to acquire 20% of AFVs as vehicles are replaced. Another recent French law provides financial aid for the acquisition of new electric vehicles.

[3] *Alternative transport fuels are defined here as "a type of motor energy which provides substantial environmental benefits over conventional fuels (petrol or diesel)" They include electricity, LPG, natural gas (NGL or CNG), alcohols, mixtures of 85% by volume or more of alcohols with other fuels, hydrogen, biofuels (such as biodiesel), etc. (This list is not exhaustive.) Alternative fuels do not include unleaded petrol, reformulated petrol or city (low-sulphur) diesel.*

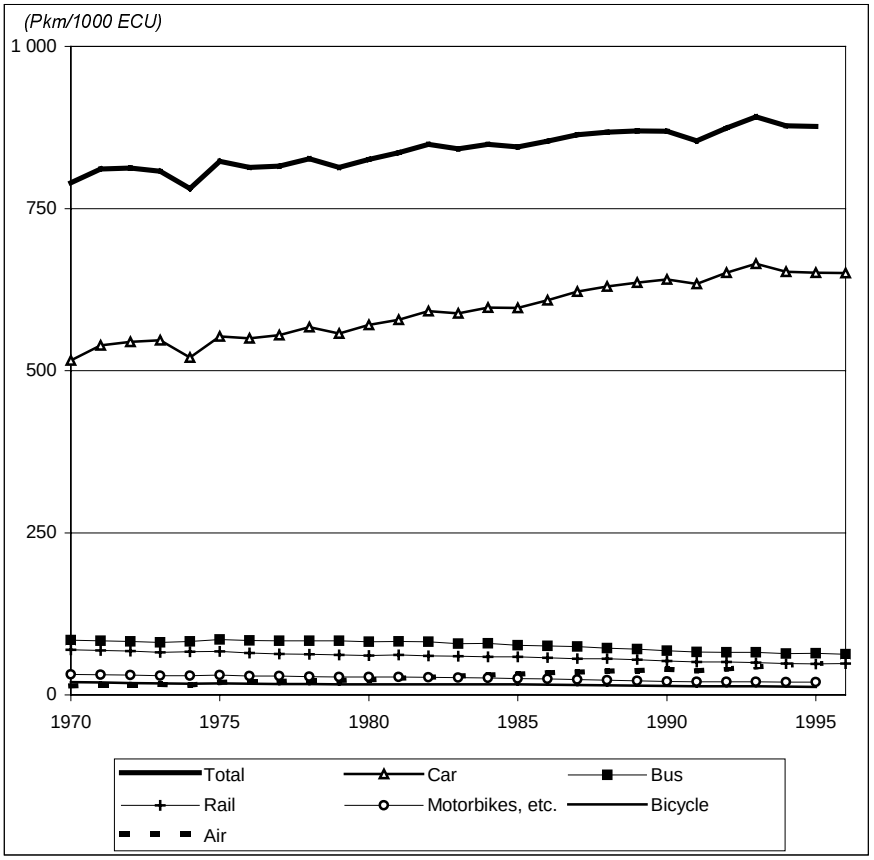

Figure 5: Passenger-km per unit GDP (EU-15)

The passenger-kilometre (pkm) represents the movement of a passenger over a distance of one kilometre. The average distance travelled in a year per unit of GDP is a measure of the transport-intensity of an economy. However, the related environmental pressures and impacts, such as energy consumption, atmospheric pollution and noise, vary according to the means of transport used.

Passenger-kilometres are difficult to quantify very precisely except for railways and buses, and definitions differ between countries and modes. For example, the figures for road transport represent national traffic by vehicles registered in the reporting country, and therefore exclude international road traffic. Nevertheless, it is quite likely that a part of this traffic is included. Rail includes national and international traffic on national networks, whereas air includes national and international transport within the EU. Data on bicycles are obtained by traffic counts and household surveys, whereas data on walking combine official statistics with the use of a model.

Since 1970, passenger-kilometres per unit of GDP (at 1990 constant prices) have grown modestly at the average rate of 0.4% per year mainly driven by an annual growth rate of 0.9% for cars and 5.1% for air (see Figure 5). An average annual growth rate of 0.5% for waterborne transport (not shown here) has had little impact due to the low volumes. Bus, rail, motorbikes and bicycles each fell by more than 1% per year on average.

Figure 6 shows that between 1970 and 1995, while population was growing rather slowly, GDP (at 1990 constant prices) grew at an average rate of 2.5% per year. Over the same period, passenger-kilometres grew at the slightly higher average rate of 2.9% per year, although since 1990 there are signs that this growth rate has been slowing down and is now similar to that of GDP.

With respect to GDP, it is important to stress its strong correlation with passenger car ownership. Given that a person has invested in a car, paid the appropriate taxes, insurance and maintenance costs, the marginal cost per journey is rather low. As wealth increases there is also an increase in travel. But increasing wealth is also associated with an increasing value of time and personal freedom, which tends to induce a shift from the slower, cheaper means of transport towards the faster, more expensive ones.

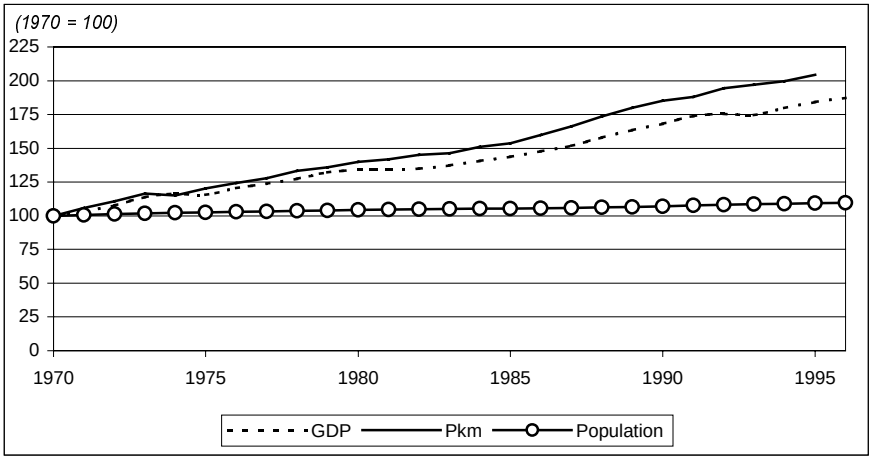

Figure 6: Indices of pkm, GDP and population (EU-15)

Tonne-kilometres per unit of GDP are a measure of the freight intensity of an economy: how much freight transport is required to produce one unit of GDP. This indicator reflects on the one hand, the dependence of an economy on the production of heavy goods and raw materials, and on the other, the development of other less transport-intensive industries such as services.

Freight tonne-kilometres per unit of GDP (at constant 1990 prices) have risen at the average rate of 0.2% per year between 1970 to 1995, although with a certain amount of fluctuation (see Figure 7).

Over this period the dominance of road transport (1.4% average growth rate per year) and short sea shipping (0.8% average annual growth) have increased, while the other modes have all decreased.

Figure 8 shows, since 1970 the growth in freight transport, as measured in tonne-kilometres, has closely followed that of GDP.

Nevertheless, between 1970 and 1995, GDP (at constant prices) has grown at an average annual rate of 2.5%, as opposed to 2.7% for freight transport. The main growth in freight tonne-kilometres has been in the transport of wood, paper pulp, chemicals, manufactured products such as glass and ceramics, and machinery, although the EU economy has become somewhat less dependent on the transport of some heavy goods (such as coal and coke, and fertilisers).

Increasing intra-EU trade and internationalisation have led to an increase in the share of international freight tonne-kilometres from 44% in 1970 to 53% in 1995, mainly by means of sea and road transport. Although tonnes transported have increased moderately, the major growth has been in the distances goods are carried.

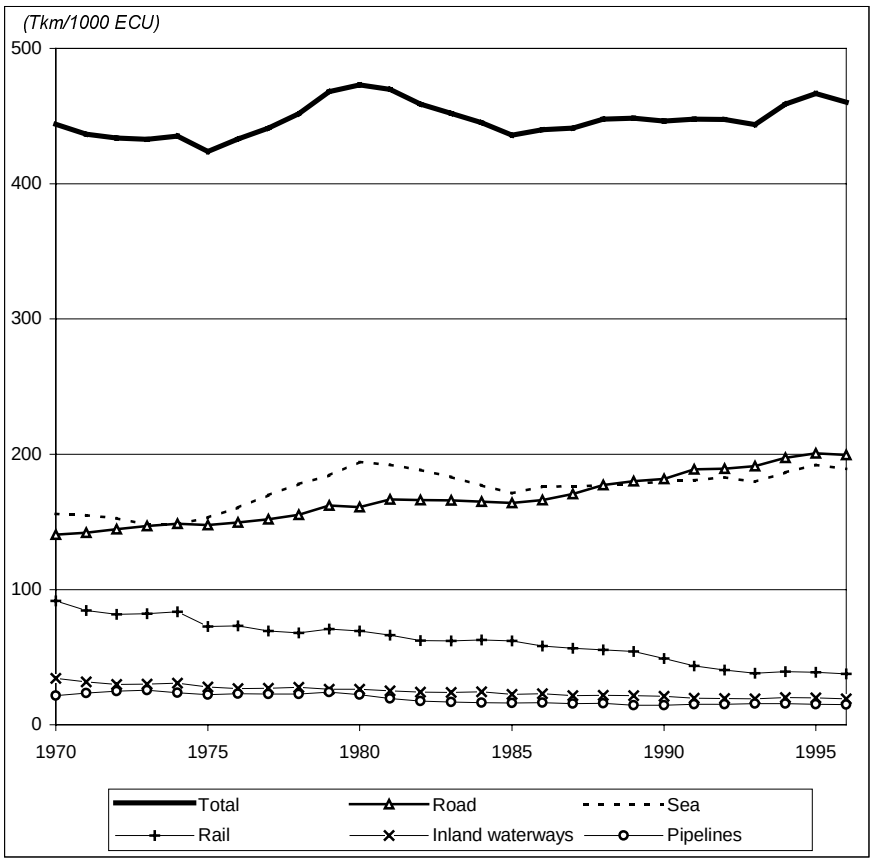

Figure 7: Freight tonne-km per unit GDP (EU-15)

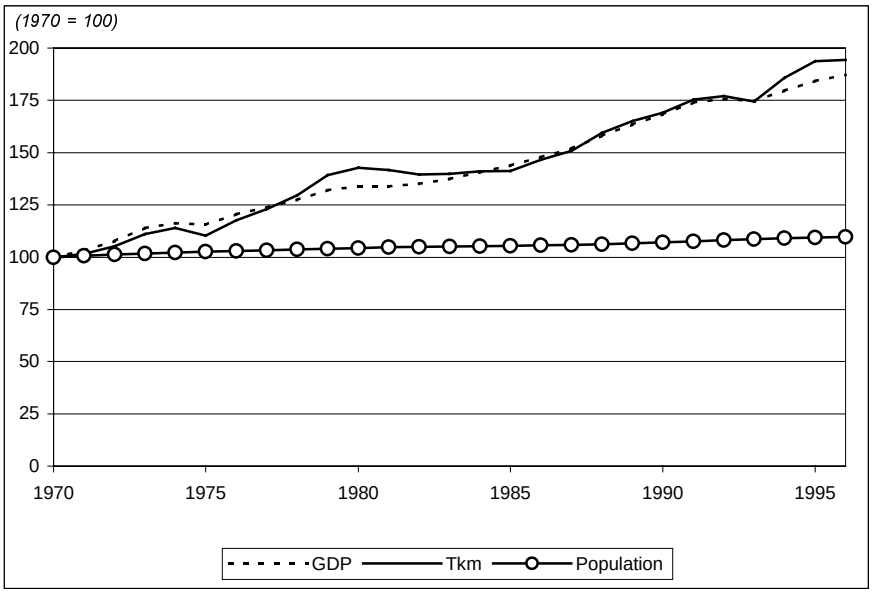

Figure 8: Indices of tkm, GDP and population (EU-15)

Background to TERM

At the beginnning of 1998 the Commission set up a Steering Group, comprising participants from the Directorates-General for Transport, Environment, and Statistics (Eurostat), and the EEA, to look at the possibility of establishing a monitoring mechanism for transport and environment. To date this group has:

- developed a preliminary list of 27 indicators;
- reviewed data availability for each indicator;
- developed a conceptual framework for the analysis of those indicators;
- conducted preliminary consultations with the Member States; and
- established co-operation with other international organisations working in the area of indicators for sustainable transport.

At the outset, the Steering Group decided that three key questions are particularly relevant for policy makers and need to be addressed by TERM:

- What is the progress in the use of technical measures (e.g. cleaner vehicles and fuels) which reduce the impacts on the environment and human health?
- Are we getting better at using transport, both within modes (e.g. improved occupancy, better driving practice), and between modes (e.g. by switching to less damaging forms of transport)?
- How are factors such as land use planning, economic activity and access to basic services, driving the growth in overall transport and in its different modes?

The "best" indicators will be those which help to answer these three policy questions and at the same time help to monitor the effectiveness of policy intervention through certain key policy leverage points such as:

- Land use planning

Land use patterns have a strong impact on the distances travelled by people for different purposes. Policies could help to minimise the need to travel and hence help reduce transport demand and ensure access to more environmentally friendly forms of transport.

- Transport planning and demand management

Increased investment in and availability of public transport, traffic management and restrictions on the movements of other vehicles are examples of how policy measures can shift the modal balance towards less damaging forms of transport.

- Transport prices and economic instruments

Prices, charges, subsidies and taxes can be used to shift the balance between modes towards an increased use of less damaging forms of transport and to influence transport demand and efficiency in general by ensuring users pay the full cost of transport, including transport externalities.

- Economic integration and transport

Transport supports economic development and the operation of the Single Market, providing access to the best and cheapest components and raw materials, enabling efficient production and distribution to take place. These factors help contribute to increased freight transport intensity, which is the amount of transport required to deliver a unit of economic activity.

- Technological improvements

Improving the efficiency in the use of resources can help to minimise the environmental impacts of transport. Smaller engine sizes, improved fuel efficiency, the use of cleaner fuels and developments such as catalytic converters are examples where technology can contribute to producing less damaging forms of transport.

The key questions and the leverage points mentioned above formed the basis for a proposed list of indicators.

This list was discussed in detail at an expert workshop hosted by EEA in March 1998, and attended by Commission and EEA staff as well as national experts. The workshop proposed 31 indicators arranged in groups, each group having at least one "priority" indicator which was felt to be particularly representative.

Since that time the list has been reviewed, and comments from DGs VII and XI have been taken into account. In particular, it was felt that 31 indicators were too many, and attempts have been made to reduce this number. A new list of 27 indicators is given in Table 1 opposite. It should be noted that this list is still a proposal and although many of the indicators will be retained, there may be some further changes made over time.

Acknowledgements

This work is the result of close cooperation with the European Environment Agency who have kindly permitted Eurostat to publish these edited extracts from their forthcoming publication.

The assistance of Alessandra Sensi in the preparation of this publication is gratefully acknowledged.

Group	Indicators
ENVIRONMENTAL PERFORMANCE OF TRANSPORT	
Environmental consequences of transport	Transport final energy consumption and primary energy consumption, and share in total (fossil, nuclear, renewable) by mode
	Transport emissions and share in total emissions for CO_2, NO_X, NMVOCs, PM_{10}, SO_X by mode
	Excedances of air quality values
	Exposure of population to traffic noise
	Infrastructure influence on ecosystems and habitats ('fragmentation') and proximity of transport infrastructure to designated sites
	Land take for transport by mode
	Number of transport accidents, fatalities, injured, polluting accidents (land, air and maritime)
DETERMINANTS OF THE TRANSPORT SYSTEM	
Land use and access to basic services	Average passenger journey time and length per mode, purpose (commuting, shopping, leisure) and territory (urban/rural)
	Access to transport services, e.g: • Number of motor vehicles per household • % of persons in a territory having in e.g. 500m distance access to a public transport station
Transport demand and intensity	**Passenger transport (by mode and purpose):** • Total passengers • Total pkm • Pkm per capita • Pkm per GDP
	Freight transport (by mode and group of goods): • Total tonnes • Total tkm • Tkm per capita • Tkm per GDP
Transport supply	Length of transport infrastructure by mode and by type of infrastructure (e.g. motorway, national road, municipal road, etc.)
	Investments in transport infrastructure/capita and by mode
Price signals	**Real passenger and freight transport price by mode**
	Fuel prices
	Taxes
	Subsidies
	Expenditure for personal mobility per person by income group
	Proportion of infrastructure and environmental costs (including congestion costs) covered by price
Efficient use of transport	Overall energy efficiency for passenger and freight transport per km travelled (per vehicle type)
	Emissions per pkm and emissions per tkm for CO_2, NO_X, NMVOCs, PM_{10}, SO_X by mode
	Vehicle occupancy
	Uptake of cleaner fuels (unleaded petrol, electric, alternative fuels) and numbers of alternative fuelled vehicles
	Load factors for road freight transport (LDV, HDV)
	Average age of the vehicle fleet
	Proportion of vehicle fleet meeting certain air and noise emission standards (by mode)
	Public awareness
NB: Indicators marked in **bold** are considered a 'priority'.	

Table 1: Preliminary list of indicators

Further information:

- **Databases**

  New Cronos
  Domain milieu

To obtain information or to order publications, data bases and special sets of data, please contact the **Data Shop** network:

BELGIQUE/BELGIË

Eurostat Data Shop
Bruxelles/Brussel
Chaussée d'Etterbeek 13
Etterbeeksesteenweg 13
B-1049 BRUXELLES / BRUSSEL
Tel. (32-2) 299 66 66
Fax (32-2) 295 01 25
E-Mail:
datashop.brussels@eurostat.cec.be

DANMARK

DANMARKS STATISTIK
Bibliotek og Information
Eurostat Data Shop
Sejrøgade 11
DK-2100 KØBENHAVN Ø
Tel. (45-39) 17 30 30
Fax (45-39) 17 30 03
E-Mail: bib@dst.dk

DEUTSCHLAND

STATISTISCHES BUNDESAMT
Eurostat Data Shop Berlin
Otto-Braun-Straße 70-72
D-10178 BERLIN
Tel. (49-30) 23 24 64 27/28
Fax (49-30) 23 24 64 30
E-Mail:
stba-berlin.datashop@t-online.de

ESPAÑA

INE Eurostat Data Shop
Paseo de la Castellana, 183
Oficina 009
Entrada por Estébanez Calderón
E-28046 MADRID
Tel. (34-91) 583 91 67
Fax (34-91) 579 71 20
E-Mail: datashop.eurostat@ine.es

FRANCE

INSEE Info Service
Eurostat Data Shop
195, rue de Bercy
Tour Gamma A
F-75582 PARIS CEDEX 12
Tel. (33-1) 53 17 88 44
Fax (33-1) 53 17 88 22
E-Mail: datashop@insee.fr

ITALIA – Roma

ISTAT
Centro di Informazione Statistica
Sede di Roma, Eurostat Data Shop
Via Cesare Balbo, 11a
I-00184 ROMA
Tel. (39-06) 46 73 31 05/02
Fax (39-06) 46 73 31 07/01
E-Mail: dipdiff@istat.it

ITALIA – Milano

ISTAT
Centro di Informazione Statistica –
Sede di Milano, Eurostat Data Shop
Piazza della Repubblica, 22
I-20124 MILANO
Tel. (39-02) 65 95 133/134
Fax (39-02) 65 30 75
E-mail: mileuro@tin.it

LUXEMBOURG

Eurostat Data Shop Luxembourg
BP 453
L-2014 LUXEMBOURG
4, rue A. Weicker
L-2721 LUXEMBOURG
Tel. (352) 43 35 22 51
Fax (352) 43 35 22 221
E-Mail: dslux@eurostat.datashop.lu

NEDERLAND

STATISTICS NETHERLANDS
Eurostat Data Shop-Voorburg
po box 4000
2270 JM VOORBURG
Nederland
Tel. (31-70) 337 49 00
Fax (31-70) 337 59 84
E-Mail: datashop@cbs.nl

NORGE

Statistics Norway
Library and Information Centre
Eurostat Data Shop
Kongens gate 6
P. b. 8131, dep.
N-0033 OSLO
Tel. (47-22) 86 46 43
Fax (47-22) 86 45 04
E-Mail: biblioteket@ssb.no

PORTUGAL

Eurostat Data Shop Lisboa
INE/Serviço de Difusão
Av. António José de Almeida, 2
P-1000-043 LISBOA
Tel. (351-1) 842 61 00
Fax (351-1) 842 63 64
E-Mail: data.shop@ine.pt

SCHWEIZ/SUISSE/SVIZZERA

Statistisches Amt des Kantons
Zürich, Eurostat Data Shop
Bleicherweg 5
CH-8090 Zürich
Tel. (41-1) 225 12 12
Fax (41-1) 225 12 99
E-Mail: datashop@zh.ch
Internetadresse:
http://www.zh.ch/statistik

SUOMI/FINLAND

Eurostat Data Shop, Tilastokirjasto
Postiosoite: PL 2B
FIN-00022 Tilastokeskus
Käyntiosoite: Työpajakatu 13 B, 2 krs
Helsinki
Tel. (358-9) 17 34 22 21
Fax (358-9) 17 34 22 79
S-posti datashop.tilastokeskus@tilastokeskus.fi
Internetadresse:
http://www.tilastokeskus.fi/tk/kk/datashop.html

SVERIGE

STATISTICS SWEDEN
Information service
Eurostat Data Shop
Karlavägen 100
Box 24 300
S-104 51 STOCKHOLM
Tel. (46-8) 783 48 01
Fax (46-8) 783 48 99
E-Mail: infoservice@scb.se

UNITED KINGDOM

Eurostat Data Shop
Enquiries & advice and
publications
Office for National Statistics
Customers & Electronic Services Unit
1 Drummond Gate - B1/05
UK-LONDON SW1V 2QQ
Tel. (44-171) 533 56 76
Fax (44-171) 533 56 88
E-Mail: gloria.ryan@ons.gov.uk

UNITED KINGDOM

Eurostat Data Shop
Electronic Data Extractions,
Enquiries & advice - R.CADE
Unit 1L Mountjoy Research Centre
University of Durham
UK - DURHAM DH1 3SW
Tel: (44-191) 374 7350
Fax: (44-191) 384 4971
E-Mail: r-cade@dur.ac.uk
URL: http://www-rcade.dur.ac.uk

UNITED STATES OF AMERICA

HAVER ANALYTICS
Eurostat Data Shop
60 East 42nd Street
Suite 3310
USA-NEW YORK, NY 10165
Tel. (1-212) 986 93 00
Fax (1-212) 986 58 57
E-Mail: eurodata@haver.com

Media Support Eurostat (for professional journalists only).
Bech Building Office A3/48 • L-2920 Luxembourg • Tel. (352) 4301 33408 • Fax (352) 4301 32649 • e-mail: media.support@eurostat.cec.be

For information on methodology

Graham Lock, Eurostat/F3, L-2920 Luxembourg, tel. (352) 4301 33406, fax (352) 4301 37316

ORIGINAL: English

Please visit our web site at **http://europa.eu.int/eurostat.html** for further information!

A list of worldwide sales outlets is available at the **Office for Official Publications of the European Communities**.

2 rue Mercier – L-2985 Luxembourg
Tel. (352) 2929 42118 Fax (352) 2929 42709
Internet Address **http://eur-op.eu.int/fr/general/s-ad.htm**
e-mail: info.info@opoce.cec.be

BELGIQUE/BELGIË – DANMARK – DEUTSCHLAND – GREECE/ELLADA – ESPAÑA – FRANCE – IRELAND – ITALIA – LUXEMBOURG – NEDERLAND – ÖSTERREICH PORTUGAL – SUOMI/FINLAND – SVERIGE – UNITED KINGDOM – ÍSLAND – NORGE – SCHWEIZ/SUISSE/SVIZZERA – BALGARIJA – CESKÁ REPUBLIKA – CYPRUS EESTI – HRVATSKA – MAGYARORSZÁG – MALTA – POLSKA – ROMÂNIA – RUSSIA – SLOVAKIA – SLOVENIA – TÜRKIYE – AUSTRALIA – CANADA – EGYPT – INDIA ISRAËL – JAPAN – MALAYSIA – PHILIPPINES – SOUTH KOREA – THAILAND – UNITED STATES OF AMERICA

Order form

I would like to subscribe to Statistics in focus (from 1.1.1999 to 31.12.1999):
(for the Data Shop and sales office addresses see above)

❒ **Formula 1**: All 9 themes (approximately 90 issues)

- ❒ Paper: 360 EUR
- ❒ PDF: 264 EUR
- ❒ Paper + PDF: 432 EUR

au Excel avec les don■ DE ❒ EN ❒ FR

❒ **Formula 2:** One or more of the following seven themes:

- ❒ Theme 1 'General statistics'
  ❒ Paper: 42 EUR ❒ PDF: 30 EUR ❒ Combined: 54 EUR
- ❒ Theme 2 'Economy and finance'
- ❒ Theme 3 'Population and social conditions'
- ❒ Theme 4 'Industry, trade and services
- ❒ Theme 5 'Agriculture and fisheries'
- ❒ Theme 6 'External trade'
- ❒ Theme 8 'Environment and energy
  ❒ Paper: 84 EUR ❒ PDF: 60 EUR ❒ Combined: 114 EUR
  Language required: ❒ DE ❒ EN ❒ FR

❒ Please send me a free copy of 'Eurostat Mini-Guide' (catalogue containing a selection of Eurostat products and services)
Language required: ❒ DE ❒ EN ❒ FR

❒ I would like a free subscription to 'Statistical References', the information letter on Eurostat products and services
Language required: ❒ DE ❒ EN ❒ FR

❒ Mr ❒ Mrs ❒ Ms

(Please use block capitals)

Name: _____ First name: _____

Company: _____ Department: _____

Function: _____

Address: _____

Post code: _____ Town: _____

Country: _____

Tel.: _____ Fax: _____

E-mail: _____

Payment on receipt of invoice, preferably by:

❒ Bank transfer

❒ Visa ❒ Eurocard

Card No: _____ Expires on: ____/____

Please confirm your intra-Community VAT number:
If no number in entered, VAT will be automatically applied. Subsequent reimbursement will not be possible.

_____